

Application No. 10/735,392
Amendment dated
Reply to Office Action of April 11, 2006

Docket No.: 66138-0005

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AUG 11 2006**REMARKS**

Applicants have carefully reviewed the Non-Final Office Action dated April 11, 2006 and thank Examiner Safavi for his detailed review of the pending claims

Claims 8-11 and 25-27 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 1, 3-5, 8-11 and 24-27 are rejected under 35 U.S.C. 102(b) as being anticipated by Japanese reference 10-292624 (JP '624). Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over either of Japanese reference 10-292624 (JP '624) or Sawyer '808 in view of European reference 623,434 (EP '434). Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Japanese reference '624 (JP '624) in view of Edison '261.

At least for the reasons set forth below, Applicants respectfully traverse the foregoing rejections. Further, Applicants believe that there are also reasons other than those set forth below why the pending claims are patentable, and reserve the right to set forth those reasons, and to argue for the patentability of claims not explicitly addressed herein, in future papers.

I. Information Disclosure Statement

Applicants disagree that the information disclosure statement received on December 27, 2004 fails to fully comply with the provisions of 37 CFR 1.97 and MPEP § 609 because Applicants have failed to provide a date of publication for the reference listed as CA. The indicated reference is the international search report corresponding to the international application claiming priority to the same priority application as the present US application. The issue date of the international search report is on the document itself. Moreover, the Information Disclosure Statement itself specifically identifies the issue date of the international search report and the cited references as follows:

Applicant(s) have become aware of the following documents, cited in an International Search Report issued September 1, 2004, during the prosecution of international application no. PCT/US03/39745, which corresponds to the above referenced application, and in accordance with 37 CFR 1.97(c) and (e)(1) or (b)(3), hereby submit(s) these documents for the Examiner's consideration.

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(Emphasis in original). Thus, to the extent necessary, it is requested that the Examiner consider the international search report.

I. Rejection of Claims 8-11 and 25-27 Under 35 U.S.C. §112

Claims 8-11 and 25-27 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The Examiner has objected to a number of the claims for including language along the lines of "a cavity associated with said pattern" suggesting it is not clear as to what is being defined. Applicants respectfully disagree. The language is clear on its face and is amply supported by the specification and figures. Nevertheless, to facilitate prosecution select claims have been amended to state that the pattern includes a cavity. Similarly, claims 9, 10, 26, and 27 have been amended to remove the word "may" to also facilitate prosecution. No detrimental alteration in claim scope is effected by the present amendments.

II. Rejection of Claims 1, 3-5, 8-11 and 24-27 Under 35 U.S.C. 102 – Japanese Reference 10-292624

Claims 1, 3-5, 8-11 and 24-27 are rejected under 35 U.S.C. 102(b) as being anticipated by Japanese reference 10-292624 (JP '624). Applicants respectfully traverse the rejection.

To anticipate a claim, the reference must teach every element of the claim. "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). "The elements must be arranged as required by the claim..." *In re Bond*, 910 F.2d 831, 15 USPQ2d 1566 (Fed. Cir. 1990); also see MPEP § 2131.

Attached as Exhibit A is an English translation of JP '624. JP '624 does not anticipate the claimed invention.

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Significantly, JP '624 teaches the use of a variety of materials and components to make box-shaped main mold form 2 in a multi-step non-molded process. First a form 100 is assembled. (Paragraph 0015 of the translation). Next a mold release treatment is performed. (Id.) Then a resin material is coated or sprayed on male pattern surface 103. (Id.). Before the resin material is completely cured, some type of reinforcing material is bonded to form a surface pattern layer. (Id.) Then using a composite resin or the like reinforcing material is consecutively laminated to create up to six layers on the surface pattern layer. (Id.). At the same time rib core plates 101 for forming the peripheral ribs having nearly the same shape as the male embossed surface and made of plywood plates, corrugated boards, foam boards, steel sheets, aluminum sheets, resin plates, honeycomb plates, etc. are set at any desired gradient and they are also laminated to form a peripheral rib layer 3 integrated with pattern layer 4 and pattern reinforcing layer 5. (Id.). A reinforcing frame member made of steel or the like is taught to be formed integrally on the upper surface of the pattern reinforcing layer and the grid rib layer. (Paragraph 0025 of the translation).

In stark contrast to the teachings of JP '624, claim 1 recites that both the base portion and the reinforcement matrix are molded in one-piece from a non-metallic, non-wooden material. First, JP '624 does not teach that the base portion and the reinforcement matrix are molded. Instead a sophisticated lamination process is required in JP '624. JP '624 requires a variety of materials in its multi-step laminated process. Further, the recited material must be non-metallic and non-wooden, while JP '624 teaches the use of plywood plates, corrugated boards, steel sheets, or aluminum sheets as well as a reinforcing frame member made of steel. Thus, claim 1 is patentably distinct.

Independent claim 24 is also patentably distinct from JP '624. Claim 24 recites that the base portion, having a front face including a pattern and a rear face is formed from a plastic material. JP '624 teaches a variety of other materials being required that are non-plastic in nature. Moreover, even if JP '624 did teach that the base portion were formed from a plastic material, JP '624 teaches directly away from the base portion and the reinforcement matrix being formed from a single material as also recited in the claim. Thus, claim 24 is patentably distinct.

For at least these reasons, independent claims 1 and 24 are patentable over the cited references. Withdrawal of the rejection is respectfully requested. Dependent claims 3-5, 8-11 and 24-27 are patentable by virtue of their dependency on patentable claims 1 or 24. However, the dependent claims also contain additional limitations that are independently patentable. For

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example, there is no teaching of fiberglass strands as recited in claim 4. Nor is there a teaching of the recitations of claims 9, 10, 24 or 27 as to cavity extension. Withdrawal of the rejection is respectfully requested.

III. Rejection of claim 3 under 35 U.S.C. § 103(a)

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over either of Japanese reference 10-292624 (JP '624) or Sawyer (US 4,150,808) in view of European reference 623,434 (EP '434). From a review of the rejection, however, it appears that the Examiner is actually rejecting claim 4. Moreover, no basis for the use of Sawyer '808 in the rejection is given. In fact, the Examiner states that Sawyer '808 does not appear to specifically disclose a form made of a plastic material that includes a fiberglass strand. Thus, it appears that the Examiner is actually combining JP '624 with EP '434 to make the rejection.

Obviousness cannot be established by combining prior art to produce the claimed invention absent some teaching or suggestion supporting the combination. The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification.

MPEP Section 2143 sets forth the basic requirements for the Patent and Trademark Office to establish *prima facie* obviousness as follows: "To establish a *prima facie* case of obviousness, three criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations."

"To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art." *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). M.P.E.P. § 2143.03. Accord. M.P.E.P. § 706.02(j).

A patent claim is obvious, and thus invalid, when the differences between the claimed invention and the prior art "are such that the subject matter as a whole would have been obvious

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at the time the invention was made to a person having ordinary skill in the art.” 35 U.S.C. § 103; *see also Graham v. John Deere Co.*, 383 U.S. 1, 14, 86 S.Ct. 684, 15 L.Ed.2d 545 (1966); *In re Dembiczak*, 175 F.3d 994, 998 (Fed. Cir. 1999). While obviousness is ultimately a legal determination, it is based on several underlying issues of fact, namely: (1) the scope and content of the prior art; (2) the level of skill of a person of ordinary skill in the art; (3) the differences between the claimed invention and the teachings of the prior art; and (4) the extent of any objective indicia of non-obviousness. *See Graham*, 383 U.S. at 17-18. When obviousness is based on the teachings of multiple prior art references, the Examiner must also establish some “suggestion, teaching, or motivation” that would have lead a person of ordinary skill in the art to combine the relevant prior art teachings in the manner claimed. *See Tec Air, Inc. v. Denso Mfg. Mich. Inc.*, 192 F.3d 1353, 1359-60 (Fed. Cir. 1999); *Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc.*, 75 F.3d 1568, 1572 (Fed. Cir. 1996). The Applicant(s) may rebut a *prima facie* showing of obviousness with evidence refuting the Examiner’s case or with other objective evidence of nonobviousness. *See WMS Gaming, Inc. v. Int’l Game Tech.*, 184 F.3d 1339, 1359 (Fed. Cir. 1999).

JP ‘624 does not anticipate or render claim 4 obvious for the reasons discussed above. However, there is no suggestion to combine JP ‘624 and EP ‘434. Significantly, EP ‘434 teaches that it is “see-through” as reflected even in the title itself. The purpose of being able to see through the form is to determine if there are problems with the concrete such as the presence of a gap. (page 3, lines 29-30). JP‘624 teaches the importance of having different laminated layers as discussed above. Thus, the problems being solved by the two references are entirely different. Moreover, JP ‘624 expressly teaches away from using the type of form as recited in EP ‘434. It talks about issues related to weight, expansion, shrinkage, cracks and adherence as well as assembly when using monolithic plastic forms. *See e.g.*, paragraphs 0003 and 0004 of the translation.

“The examiner must show reasons that the skilled artisan, confronted with the same problem as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed.” *In re Rouffet*, 47 USPQ2d, at 1458 (Fed. Cir. 1998)

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In re Fritch provides that “the Examiner bears the burden of establishing a *prima facie* case of obviousness based upon the prior art,” and that “the Examiner can satisfy this burden only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references.” 23 USPQ2d. 1780, at 1783. In focusing efforts to meet this burden, the Federal Circuit concluded that “under section 103, teachings of references can be combined *only* if there is some suggestion or incentive to do so.” *Id.* (Emphasis in original).

It is also respectfully submitted that the Examiner has not provided adequate motivation for the combination of the references, including Sawyer '808, as noted above.

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CONCLUSION

All rejections have been addressed. In view of the above, the presently pending claims are believed to be in condition for allowance. Accordingly, reconsideration and allowance are respectfully requested and the Examiner is respectfully requested to pass this application to issue. It is believed that any fees associated with the filing of this paper are identified in an accompanying transmittal.

However, if any additional fees are required in connection with the filing of this paper, permission is given to charge our Deposit Account No. 18-0013, under Order No. 66138-0005 from which the undersigned is authorized to draw. To the extent necessary, a petition for extension of time under 37 C.F.R. 1.136(a) is hereby made, the fee for which should be charged against the aforementioned account.

Dated: 08/11/06

Respectfully submitted,

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EXHIBIT A

Japanese Kokai Patent Application No. Hei 10[1998]-292624

Job No.: 1991-102889

Ref.: JP10292624A

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KOKAI PATENT APPLICATION NO. HEI 10[1998]-292624

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Examination Request: Not filed

THREE-DIMENSIONAL DECORATIVE CONCRETE MOLD FORM FOR FORMING
EMBOSSED PATTERN WITH THREE-DIMENSIONAL CURVES AND HAVING
HOLDERS FOR HOLDING SIDE PRESSURE OF CONCRETE AND FORMING METHOD
THEREOF

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[There are no amendments to this patent.]

Abstract

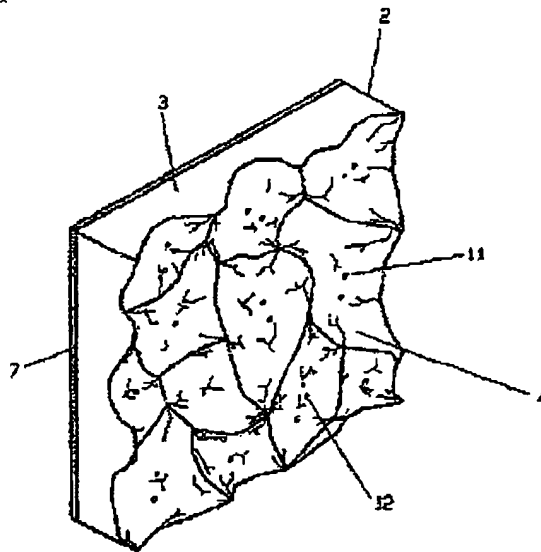
Purpose

To provide a type of mold form for three-dimensional decorative concrete characterized by the fact that the three-dimensional decorative concrete mold form for forming an embossed

pattern with three-dimensional curves is lightweight, can form an embossed pattern with a large height, is inexpensive, and allows easy assembly of the mold form and easy mold release.

Constitution

In a three-dimensional decorative concrete mold form made of a composite resin of hard resin and elastic resin, etc., an embossed pattern layer is uniformly laminated and reinforced, and the peripheral layer and grid rib layer are formed monolithically on the back side of the decorative mold form; at the same time, holders for holding the side pressure of concrete are embedded in the embossed pattern layer.



Claims

1. A type of three-dimensional decorative concrete mold form for forming an embossed with three-dimensional curves and for embedding holders for holding the side pressure of concrete, characterized by the following facts: an embossed pattern with three-dimensional curves for a mold form for forming this pattern in three-dimensional decorative concrete is laminated nearly uniformly as a composite resin laminate of hard resin and elastic resin, etc.; on the periphery with the inner surface of the embossed pattern with three-dimensional curves, a peripheral rib layer is formed with any desired gradient on the inner side; at the same time, a decorative mold form and a grid rib layer for side pressure reinforcement of concrete are formed integrally with the embossed pattern reinforcing layer and peripheral rib layer, inside said peripheral rib layer.

2. The mold form for three-dimensional decorative concrete described in Claim 1 characterized by the fact that multiple holders that hold the side pressure of concrete are

embedded in the grid rib layer formed integrally with the reinforcing layer of the embossed pattern with three-dimensional curves and the peripheral rib layer, as well as in the embossed pattern layer and the embossed pattern reinforcing layer.

3. The three-dimensional decorative concrete mold form for forming an embossed pattern with three-dimensional curves and having holders for holding the side pressure of concrete embedded in it described in Claim 1 or 2 characterized by the fact that the peripheral rib layer and grid rib layer are formed with nearly in the same shape as the embossed pattern layer with three-dimensional curves.

4. The three-dimensional decorative concrete mold form for forming an embossed pattern with three-dimensional curves and having holders for holding the side pressure of concrete embedded in it described in Claim 1 or 2 characterized by the fact that on the upper surface of the peripheral rib layer and grid rib layer on the inner surface of the embossed pattern layer, a reinforcing material made of steel material or the like is formed integrally with the three-dimensional decorative concrete mold form by means of screws, bolts, adhesive, etc.

5. The three-dimensional decorative concrete mold form for forming an embossed pattern with three-dimensional curves and having holders for holding the side pressure of concrete embedded in it described in Claim 1, 2, 3 or 4 characterized by the fact that at arbitrary sites on the surface of the pattern of the three-dimensional decorative concrete mold form described in Claim 1, 2, 3 or 4, multiple fastening devices are set for fastening pattern molds that allow freely changing the embossing height and pattern locations on the surface of the embossed pattern.

6. A method for manufacturing the three-dimensional decorative concrete mold form for forming an embossed pattern with three-dimensional curves and having holders for holding the side pressure of concrete embedded in it described in Claim 1, 2, 3, 4 or 5 characterized by the fact that silicon grains and grains and powder that bond little with silicon powder or other cements are mixed in the pattern layer of composite resin made of hard resin, elastic resin, etc.

Detailed explanation of the invention

[0001]

Technical field of the invention

The present invention pertains to a type of decorative mold form for forming a decorative concrete structure having a three-dimensional embossed pattern, and its forming method.

[0002]

Prior art

A concrete mold form for forming a decorative embossed pattern in the prior art is usually prepared as follows: a male mold of simulated rock to be formed is arranged

appropriately in a steel pallet; elastic resin is then flowed in and cured to form a decorative mold form made of resin. Alternatively, a decorative mold form is formed from a polystyrene based resin foam. As another scheme, a plastic mold form for concrete is formed monolithically.

[0003]

Problems to be solved by the invention

Said mold form for shaping concrete with a decorative embossed pattern is prepared by injecting an elastic resin into a steel pallet as explained above. However, when concrete is formed in the decorative mold form and is then cured, heated and released from the mold, the elastic resin in the steel pallet expands and shrinks, cracks and adheres poorly, allowing concrete to enter into the gap between the steel pallet and elastic resin, and other problems with the surface of the concrete pattern develop. Also, the height of the pattern is about 60 mm for said steel pallet decorative mold form. For a decorative mold form for a pattern with a height of 60 mm or larger to realize a good design effect, the overall weight must be large, the transport cost is high, the productivity is low, and, the cost of the product rises due to the increase in the quantity of elastic resin. This is undesirable.

[0004]

Also, for a decorative mold form made of polystyrene based resin foam, when the mold is released after curing of the concrete, the surface of the mold forms cracks and is damaged, so that it cannot be used repeatedly. Consequently, the decorative mold form becomes industrial waste, creating a problem. Also, for a mold assembly made of [monolithic] plastic mold forms, when assembly is performed by means of separators, cones, form ties, and other fastening members, conical holes are formed at arbitrary sites of the surface of the pattern as the form parts are assembled, and separators are attached. In this case, due to the height differences of the embossed pattern, the length of the separator has to be changed each time. Consequently, it is necessary to have multiple separators, and the efficiency of the form assembly operation becomes much lower.

[0005]

Also, depending on the pattern thickness of the embossed pattern, it may be impossible for a worker to get between the decorative mold form for the embossed pattern and the inner plate (plywood panel or the like) to form separator insertion holes with a drill or the like, and it is impossible to attach fastening members at arbitrary sites with respect to the side pressure of the concrete. Also, for the decorative mold form assembled with separators, cones, form ties, or other fastening members, when the decorative mold form is to be disassembled after formation

of the concrete pattern, if the decorative mold form for the embossed pattern is not moved gradually for the same distance in the single direction, it may be caught in the insertion opening of the separator of the decorative mold form due to the male screw portions of the multiple separators protruding on the inner surface, so that mold release cannot be performed easily, and the mold release operation is very inefficient. Also, when the mold release operation is performed by force, the male screw portion may be bent, the separator protrusion site on the concrete surface may be damaged, and the mold form itself may be broken. This is undesirable.

[0006]

Also, when a portion of the height difference of the embossed pattern of the decorative mold form must be changed, the embossed pattern of the decorative mold form has to be newly manufactured, and it is impossible to easily change the height difference for a portion of the embossed pattern onsite.

[0007]

The purpose of the present invention is to solve the aforementioned problems of the prior art by providing a type of decorative mold form characterized by the fact that the decorative mold form itself is lightweight and strong, and it is possible to obtain an embossed pattern without limiting the pattern height. Also, the mold release properties with concrete are good, and it is easy to change the embossed pattern height and pattern at multiple sites of the embossed pattern. With the mold form for three-dimensional decorative concrete provided by the present invention, it is possible to form an embossed pattern with three-dimensional curves and having holders for holding the side pressure of concrete embedded in it, with increased efficiency of the decorative mold form assembly operation, and in the mold release operation.

[0008]

Means for solving the problems

In order to realize the aforementioned purpose, for the decorative mold form of the present invention, a form is assembled on the periphery of the male mold for forming peripheral ribs with any gradient made of plywood plates, corrugated boards, foam boards, steel sheets, aluminum sheets, resin plates, honeycomb plates, etc. After mold release treatment of the male peripheral form or the like in order to prevent expansion/shrinking, cracks, wear, etc., and in order to improve the mold release properties between the decorative mold form and the concrete, a composite resin laminate material made of hard resin and elastic resin, etc., having an appropriate quantity of grains and powder of glass, silica, calcium carbonate, carbon, silicon, fluorine [sic, fluorine compounds], etc., mixed in it is coated and sprayed to form a layer with

any desired thickness on the male mold surface, followed by applying fibercloth or other reinforcing material on it to form a surface pattern layer. Also, fibercloth, fiber mesh or the like is again laminated on the formed surface pattern layer using the composite laminating material and resin, etc., in any desired thickness to form a pattern layer, pattern reinforcing layer, and peripheral rib layer.

[0009]

The grid rib layer of the reinforcing ribs is formed by forming an embossed pattern at the prescribed sites with a well-known comb-shaped forming unit. The formed shape is mapped on the internal reinforcing material of the ribs, and the rib core material that can be cut with a jigsaw or the like is temporarily secured by means of nails, wood screws, adhesive, etc. Fibercloth, fiber mesh, resin mesh or the like is used as the composite laminating material for laminating reinforcement to form a mold form for three-dimensional decorative concrete. A grid assembly reinforcing frame material made of steel material or the like is formed integrally using resin concrete, mortar blended with chopped fibers, etc., on the top end of the peripheral rib layer and grid rib layer of said mold form for three-dimensional decorative concrete.

[0010]

For the multiple holders for holding the side pressure of concrete embedded in the embossed pattern layer and grid rib layer at arbitrary embedding sites in the surface of the male pattern, temporary attachment of cones, rubber hoses, clay, etc., subjected to mold release treatment is performed on the pattern surface by means of caulking agents and adhesives. After the pattern layer and pattern reinforcing layer are laminated with a composite resin laminating material and this has cured, holders are fitted and fixed in the fitting holes obtained by removing said cones, rubber hose, clay, or the like, followed by composite laminating and reinforcement with resin concrete, chopped fiber mortar, resin, fibercloth, fiber mesh, rein mesh, etc., so that the holders are embedded in the embossed pattern layer and grid rib layer, including the pattern layer and pattern reinforcing layer.

[0011]

For the peripheral rib layer and grid rib layer having nearly the same shape as that of the embossed pattern layer with three-dimensional curves, after measurement of the shape with a comb-shaped shape profiler, the embossed pattern is mapped to the plate for embedding and cut along the mapping line with a cutter or the like. The cut and formed peripheral rib core material and grid rib core material are then laminated and reinforced with a composite resin laminating material made of hard resin, etc., using fibercloth, fiber mesh, resin mesh, etc. The mold form for

three-dimensional decorative concrete is fabricated in this way. Also, multiple fastening devices for fastening pattern molds that allow freely changing the embossment height and pattern locations of the surface of the embossed pattern are attached at arbitrary sites of the embossed pattern layer of the mold form for three-dimensional decorative concrete. These are laminated and reinforced to nearly a uniform thickness using a resin made of hard resin and elastic resin, etc.

[0012]

Operation

For the present invention with the aforementioned constitution, even large decorative mold forms with different elevations of the embossed pattern allow easy form assembly and mold release of mold forms for three-dimensional decorative concrete by virtue of the holders embedded in the embossed pattern layer and rib reinforcing layer. Consequently, the obtained mold form for three-dimensional decorative concrete can withstand the side pressure of concrete and allows repeated uses.

[0013]

For the holders embedded in the embossed pattern reinforcing layer, the bolts screwed into the embedded holders are marked to indicate half the dimension of the coupling nut in the concrete and the dimension of the cone. The decorative mold form mold release operation can be realized easily after placement of the concrete by simply screwing out the bolts to said marked position. On the top end of the grid rib layer formed on the peripheral rib layer formed on the periphery of the embossed pattern layer and on the inner surface of the embossed pattern layer, a reinforcing mold form made of steel material or the like is integrally formed by means of resin concrete, chopped fiber blended mortar or the like. As a result, it is possible to form the height dimension of the decorative mold form correctly, and at the same time, it is possible to prevent chipping, voids, cracks, etc., and to hold the side pressure of the concrete with high reliability. Also, for the multiple partial pattern replacement fastening devices set at arbitrary desired sites on the embossed pattern surface, it is possible to easily fasten mold forms that can change the height and embossed pattern of the embossed pattern surface at will. As a result, the desired embossed pattern surface can be obtained.

[0014]

Embodiment of the invention

In the following, an embodiment of the present invention will be explained with reference to application examples illustrated with figures. Figure 1 is an overall oblique view illustrating

the process of formation of the three-dimensional decorative concrete mold form for forming a male embossed pattern with three-dimensional curves and having holders for holding the side pressure of concrete embedded in it. Figure 2 is an overall oblique view of the female mold form. Figure 3 is a back oblique view of the female mold form. Figure 4 is a longitudinal cross section of Figure 2. Figure 5 is an enlarged cross section of the main portion of Figure 4. Figure 6 is an overall oblique view of the female embossed pattern mold form described in Claim 3. Figure 7 is a back oblique view of Figure 6. Figure 8 is a diagram illustrating the mold form assembly using the mold form described in Claim 3. Figure 9 is a diagram illustrating the mold form assembly using the female mold form described in Claim 1. Figures 10(a), (b), (c) illustrate the mold release operation after forming of the concrete using the female mold form described in Claim 1. Figures 11(a), (b), (c) are cross sections illustrating the main part of the mold release process using the decorative mold form in the prior art. Figure 12 is a diagram illustrating attachment of the pattern mold on the mold form. Figure 13 is a cross section illustrating a method of connecting and fixing this mold form.

[0015]

In Figures 1, 2 and 3, (2) represents the box-shaped main mold form. After form (100) for forming ribs on the periphery of the male mold is assembled, and mold release treatment is performed, a composite resin material prepared by adding an appropriate quantity of grains or powder of glass, silica, calcium carbonate, silicon, carbon, fluorine etc., for preventing expansion, shrinking, cracking, wear and for improving mold release properties, to a resin prepared by adding a curing agent to a principal agent made of hard resin and elastic resin, etc. This is coated or sprayed on male pattern surface (103) to form a layer of about 0.5-3.0 mm thick. Before the composite resin material is completely cured, fibercloth or other reinforcing material is bonded to form a surface pattern layer. Then, using a composite resin or the like, fibercloth, fiber mesh, or another reinforcing material is consecutively laminated to create 1-6 layers on the surface pattern layer, forming pattern layer (4) and pattern reinforcing layer (5). At the same time, rib core plates (101) for forming the peripheral ribs having nearly the same shape as the male embossed surface and made of plywood plates, corrugated boards, foam boards, steel sheets, aluminum sheets, resin plates, honeycomb plates, etc., are set at any desired gradient, and they are also laminated to form a peripheral rib layer (3) integrated with pattern layer (4) and pattern reinforcing layer (5).

[0016]

For peripheral rib layer (3) and grid rib layer (6), the embossed pattern at the site where the rib layer is to be formed is mapped with a conventional comb-shaped shape profiler; the

mapped embossed pattern is mapped onto rib core plate (101) made of plywood, corrugated board, steel sheet, aluminum sheet, resin plate, foam plate, honeycomb board, etc., followed by cutting to obtain an in-rib reinforcing material. The obtained in-rib reinforcing material is temporarily fixed at the rib formation site. Laminating resin, fibercloth, fiber mesh, etc., are used to perform appropriate laminating reinforcement on the surface of the in-rib reinforcing surface as well as on pattern reinforcing layer (5) and peripheral rib layer (3). After the rib surface reinforcing layer has cured, grid-shaped reinforcing frame (7) made of steel material, etc., is formed monolithically on the top end of peripheral rib layer (3) and grid rib layer (6) formed in flat shape via resin concrete, chopped fiber blended mortar, or the like. Also, when multiple mold forms for three-dimensional decorative concrete are connected to form a pseudo rock structure, the individual decorative mold forms are formed at a constant height so that assembly can be performed easily by means of grid pipes and other assembly materials, with the embossed patterns of the various decorative mold forms matching up with each other.

[0017]

Holders (8) for holding the side pressure of concrete come in square, hexagonal, cylindrical or other columnar shapes. Collar (10) is welded integrally at arbitrary positions on the outer periphery of female threaded portions (not shown in the figure) and holder (8). Cones, rubber hoses, clay or the like (102) are used to form a protruding shape temporarily fixed at any position of male pattern surface (103). Pattern layer (4) and pattern reinforcing layer (5) are laminated at will. After curing of pattern reinforcing layer (5), the cones, rubber hoses, clay or the like (102) are removed, forming fitting hole (11). Holder (8) is fitted into said hole such that the two end portions of holder (8) do not project from the outer and inner surfaces of pattern layer (4) and pattern reinforcing layer (5), and a resin concrete or a chopped fiber blended mortar or the like is used to fill in the gap between pattern reinforcing layer (5) and collar (10) of holder (8), while a composite resin is laminated for reinforcement via fibercloth, fiber mesh, resin mesh, or the like.

[0018]

As shown in Figure 8, mold form (2) has peripheral rib layer (3) and grid rib layer (6) formed beforehand in the same shape as that of pattern layer (4). Consequently, it is possible to fasten the form assembly members set on the inner surface of mold form (2) at the prescribed positions. As the fastening means, the fastening member of separator (14) is screwed on and fixed via reinforcing plate (21) made of steel or hard resin or the like on the other side of coupling nut (16) screwed to holder (8) embedded in pattern layer (4) and pattern reinforcing layer (5). Then, by screwing on and fixing nut (20) from the washer side of the cylindrical pipe

rib of reinforcing plate (21), mold form (2) can be fastened easily with a prescribed spacing maintained. Also, with regard to the positions for embedding holders (4) [sic; (8)] in mold form (2), they are embedded in the pattern layer (4) and pattern reinforcing layer (5). However, it is also possible to embed them in the rib layers, respectively. In this case, it is clear that strong holders can be obtained.

[0019]

As shown in Figure 9, mold form (2) is assembled by means of plywood panels (13) or the like. From the back side of pattern reinforcing layer (5), coupling nut (16) with one end formed as a male threaded portion is threaded via holder (8) and sleeve (15) made of synthetic resin or synthetic rubber or the like on coupling nut (16a). As a result, it is easy to attach separator (17) without making a separator insertion hole by means of a drill or the like. Also, by adjusting the length of the male threaded portion of said coupling nut (16) according to the thickness of the embossed pattern, it is possible to attach separator (17) easily even for a very deep decorative mold form. As a result, the form assembly efficiency can be improved.

[0020]

Figure 10 is a diagram illustrating the operation in which concrete is cast in the above mold form (2), followed by curing of the concrete and then mold release of the concrete product from said mold form (2). After the removal of nuts (20) and rib washers (19) set on the inner side of reinforcing frame (7) formed integrally with said mold form (2), grid pipe facing member (18) and separator (14) are removed from coupling nut (16) prepared by cutting a bolt to any desired length and having one end formed with female threads and the other end formed with male threads. By unscrewing coupling nut (16) for a distance corresponding to the central half of coupling nut (16a) and the dimension of the cone embedded and fixed in concrete (22), there is no member that projects from the surface of mold form (2). As a result, mold release from concrete surface (4a) can be performed easily.

[0021]

Also, sleeve (15) made of a synthetic resin or a synthetic rubber or the like and embedded in concrete surface (4a) becomes deformed into a convex shape in its central portion due to fastening of the male nut portion of coupling nut (16) and coupling nut (16a). After mold release, it is released from the fastening of male threaded portion of coupling nut (16) and coupling nut (16a) and returns to the normal state. Consequently, a gap is generated on the periphery of sleeve (15), so that it can be easily removed from the concrete. As a result, sleeve (15) can be used repeatedly. Also, if the diameter of sleeve (15) is well fitted to the outer periphery of the male

threaded portion, the gap in the surface of the concrete caused by removal of sleeve (15) is smaller, so that the abnormal appearance of the concrete pattern surface in the finishing operation becomes less significant.

[0022]

Figures 11(a), (b), (c) illustrate the mold release process with a conventional decorative mold form. Although cylindrical pipe facing member (18), washer (19) for cylindrical pipe, and other fastening members are removed from decorative mold form (24), the multiple separators of the fastening members set in decorative mold form (24) are not removed from decorative mold form (24). Consequently, while they are projecting from the inner surface of decorative mold form (24), decorative mold form (24) itself with a certain weight is moved slowly for a certain distance in one direction to remove decorative mold form (24). Also, because the entirety of cone (23) is embedded in the surface of the concrete without a gap, it is very difficult to remove it from the concrete surface. Even if it can be taken out, the surroundings of cone (23) may become notched, and the pattern surface becomes spoiled.

[0023]

Figures 12(a), (b) are diagrams illustrating the process of the operation in which pattern mold (26), made of a resin composite of hard resin and elastic resin, etc., laminated material, urethane rubber or another synthetic rubber, is fastened on any position of pattern layer surface (4). Fastening hole (12) passes through pattern layer (4) and pattern reinforcing layer (5), and it can have any desired shape and dimensions. On the inner surface portion of pattern mold (26), the shape near fastening hole (12) is formed as mapped from the male form shape beforehand, and at the same time, female threaded member (27) is embedded at the site symmetric with fastening hole (12), so that the pattern portion is higher than the male form pattern, and the shape is changed together with the pattern. Consequently, bolt (29) is inserted from the inner surface side of pattern reinforcing layer (5) in fastening hole (12), and it is appropriately screwed into and fixed in female threaded portion (27) of pattern mold (26). As a result, the height and pattern of the embossed surface of pattern layer (4) can be changed and adjusted. At the same time, the through-holes not in use, that is, the sites where adjustments for changes of the pattern surface are not to be made, are covered with caps or other lids to maintain the pattern surface. Also, by manufacturing various pattern molds (26) beforehand, it is also possible to adjust the height of the convex portions in addition to the concave portions. Also, the retention means for pattern mold (26) need not be bolts (29). Instead, fastening may be done with adhesive or other means.

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[0024]

Figure 13 is a diagram illustrating a means for connecting and fixing multiple mold forms (2). In this case, connecting member (31) has one end fixed in a rotatable way on any of multiple sites of peripheral rib layer (3) and has another end formed as a male threaded portion. Gap portion (28) formed when mold forms (2) are placed in contact with each other is filled with fitting member (25) made of synthetic resin, synthetic rubber or the like, and this is placed through connecting member (31) in a movable way, with nut (20) being applied for preventing its falling off. Also, recess (30) fitted with a portion of connecting member (31) is set at the site of peripheral rib layer (3) facing connecting member (31). In said recess (30), while connecting member (31) is rotated, fitting member (25) fits gap portion (28) and is fastened with nut (20). In this way, mold forms are connected and fixed to each other reliably. The means of connecting the mold forms are not limited to said scheme. For example, connection and fixing may also be performed by means of multiple bolts applied to the edge rib side surface.

[0025]

Effects of the invention

As explained above, for the mold form for three-dimensional decorative concrete of the present invention, holders for holding the side pressure of concrete are embedded in the female mold form, and the peripheral rib layer and grid rib layer are formed from plywood, corrugated boards, steel sheets, aluminum sheets, resin plates, foam plates, honeycomb boards, or other in-rib reinforcing plates formed integrally with the pattern reinforcing layer made of fibercloth, fiber mesh, or other reinforcing materials. A reinforcing frame member made of steel or the like is formed integrally on the upper surface of the pattern reinforcing layer and the grid rib layer. As a result, level setting in mold assembly can be performed easily, the decorative mold form can effectively withstand the side pressure of the concrete when the concrete is cast. It can be used repeatedly to cast several hundred or more concrete patterns, something that was impossible in the prior art.

[0026]

Also, in the mold form for three-dimensional decorative concrete of the present invention, fitting holes are formed beforehand, by means of cones, rubber hoses, or the like, for the multiple holders embedded in the pattern layer of three-dimensional curve and the pattern reinforcing layer, and in another method the holes are formed by drilling after mold release. The holders are fitted in the fitting holes, and they are then laminated and reinforced while embedded by means of composite resin and laminating materials such as fibercloth, fiber mesh, resin mesh, etc. Consequently, embedding can be easily performed even for a decorative mold form with a highly

complicated embossed pattern. As a result, the length of the bolt inserted and threaded in the sleeve and coupling nut during the mold assembly operation is predetermined. Consequently, the length of the rubber cone and taper cone connected inside the concrete can be selected at will. As a result, the embedding depth of the coupling nut embedded in the concrete can be selected at will. Consequently, the operation of fastening the round separators, etc., can be simplified. Also, in the mold release operation after casting concrete, the projecting members of the multiple round separators, bolts, etc., do not protrude from the surface side, so that the mold release operation becomes easier, and the sleeve trace on the concrete surface becomes smaller and free of damage, so that repairs can be minimized. As a result, it is possible to significantly increase the efficiency of form assembly, mold release, repair, etc., and at the same time, it is possible to guarantee the safety of the operators.

[0027]

For the decorative mold form, the main body of the decorative mold form and the peripheral rib layer and grid rib layer are formed with nearly the same shape. The pattern layer and the pattern reinforcing layer as well as the peripheral rib layer and grid rib layer are formed by laminating and reinforcing the entire pattern with composite resin and laminating material, such as fibercloth, fiber mesh, resin mesh, etc. Consequently, the decorative mold form itself is lightweight and has high strength. Also, the quantity of manufacturing material used for the decorative mold form, especially that for higher embossed patterns, is smaller than that required in the prior art. Consequently, it is possible to manufacture large mold forms for three-dimensional decorative concrete with low mold form manufacturing costs and low transportation costs.

[0028]

Also, for any detached mold form made of a compound resin laminate of hard resin and elastic resin, etc., female threaded members are embedded during the pattern mold manufacturing process at sites facing the fastening holes at arbitrary sites of the pattern layer and pattern reinforcing layer, with laminating reinforcement. By inserting bolts in the fastening holes from the inner surface of the decorative mold form and screwing and fixing them in the female screws set in the mold form, they are integrated with the pattern layer, and it is possible to change and adjust the height and pattern of the embossed pattern. Consequently, the mold form for one embossed pattern allows freely changing the embossed pattern to multiple other receiving positions.

[0029]

When the decorative mold form of the present invention is manufactured, mixing grains or powder of silicon, carbon, fluorine, etc., in the composite resin of hard resin and elastic resin, etc., and in the laminating material enables the mold release properties to be improved for the composite resin laminate, and mold release is easily performed after casting the concrete. Also, because the entire decorative mold form is formed monolithically with the composite resin laminating material, there is no need to use plywood mold forms, synthetic foam resin mold forms or other disposable mold forms. Consequently, no industrial waste is generated. This is another advantage.

Brief description of the figures

Figure 1 is an overall oblique view illustrating the process of manufacturing the decorative mold form.

Figure 2 is an overall oblique view of the decorative mold form.

Figure 3 is a back oblique view of the decorative mold form.

Figure 4 is a longitudinal cross section of Figure 1.

Figure 5 is an enlarged longitudinal cross section of the main portion of Figure 4.

Figure 6 is an overall oblique view of the decorative mold form described in Claim 3.

Figure 7 is a back oblique view of the decorative mold form described in Claim 3.

Figure 8 is a diagram illustrating the form assembly using the mold form described in Claim 3.

Figure 9 is a diagram illustrating the form assembly using said mold form.

Figure 10 is a diagram illustrating the mold release operation after curing of the cast concrete using said mold form.

Figure 11 is a cross section illustrating the mold release process using the decorative mold form of the prior art.

Figure 12 is a diagram illustrating the process of attachment of a pattern mold to said mold form.

Figure 13 is a diagram illustrating a method of connecting and fixing the mold form.

Explanation of symbols

- 1 Male mold
- 2 Mold form for three-dimensional decorative concrete for forming embossed patterns with three-dimensional curves and for embedding holders for holding the side pressure of concrete
- 3 Peripheral rib layer
- 4 Pattern layer

- 4a Concrete pattern surface
- 5 Pattern reinforcing layer
- 6 Grid rib layer
- 7 Reinforcing form
- 8 Holding device
- 9 Screw
- 10 Collar
- 11 Fitting hole
- 12 Fastening hole
- 13 Plywood panel
- 14 Separator
- 15 Sleeve
- 16 Coupling nut with male thread
- 16a Coupling nut
- 17 Separator
- 18 Grid pipe facing member
- 19 Rib washer for pipe
- 20 Nut
- 21 Reinforcing plate
- 22 Concrete
- 23 Cone
- 24 Decorative mold form
- 25 Fitting member
- 26 Pattern mold
- 27 Female screw
- 28 Gap
- 29 Bolt
- 30 Recess
- 31 Connecting member
- 100 Peripheral form
- 101 Plate for peripheral rib core
- 102 Cone, rubber hose
- 103 Male embossed surface

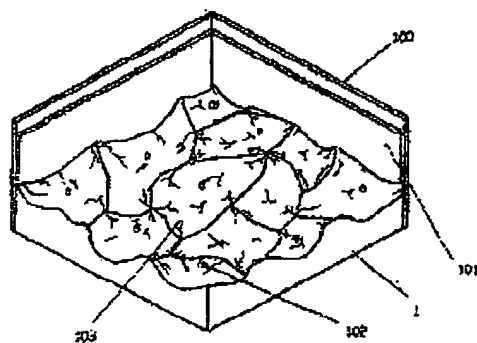


Figure 1

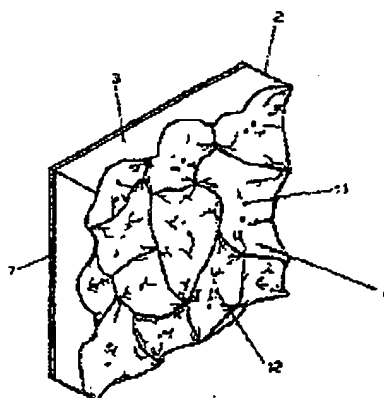


Figure 2

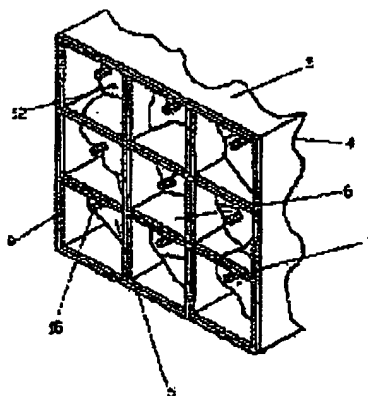


Figure 3

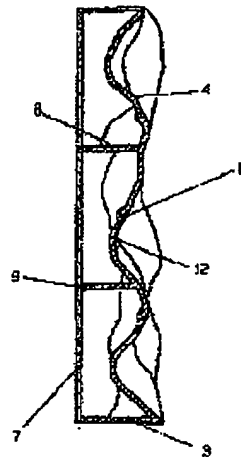


Figure 4

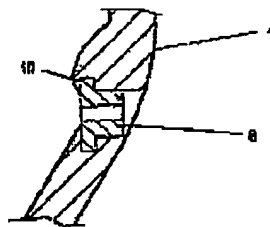


Figure 5

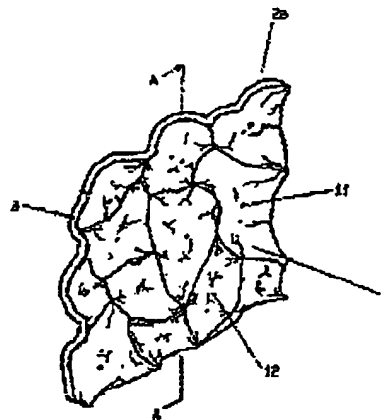


Figure 6

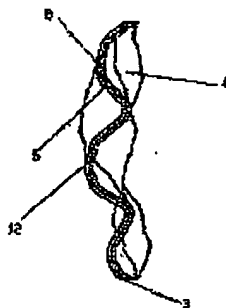


Figure 7

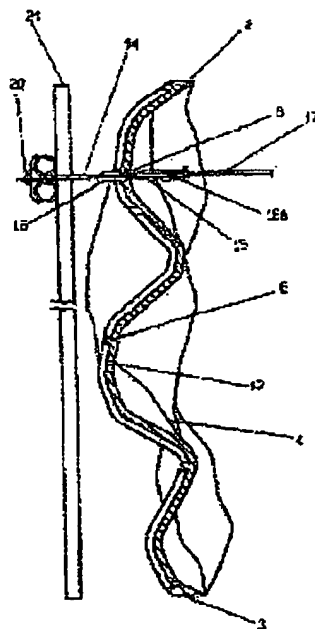


Figure 8

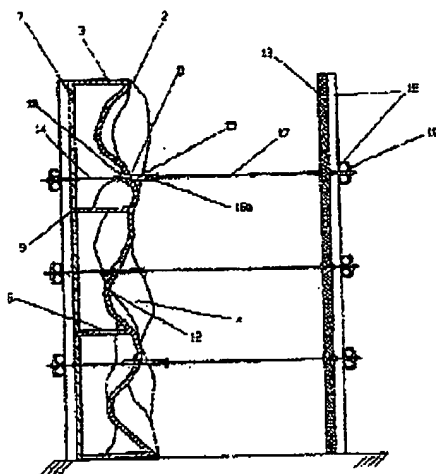


Figure 9

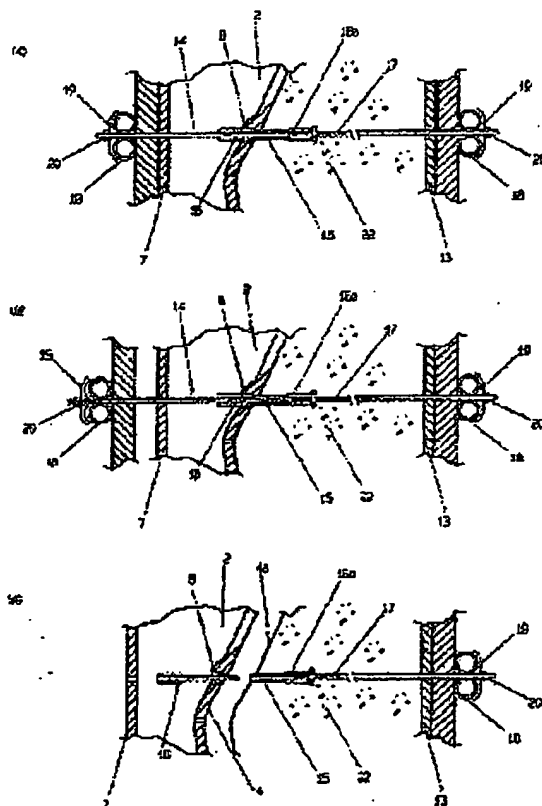


Figure 10

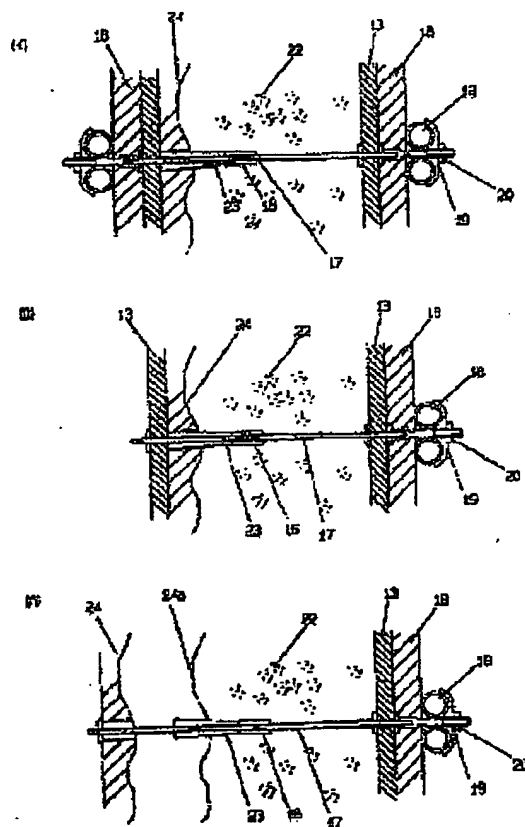


Figure 11

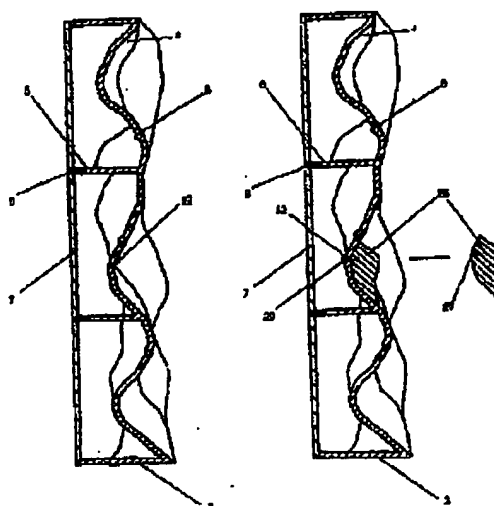


Figure 12

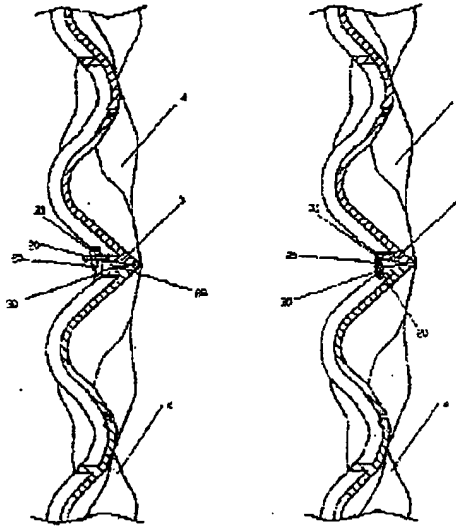


Figure 13